

Individual-Level and Community-Level Determinants of Skilled Birth Attendance in Nigeria: A Multilevel Analysis of DHS Data

Sunday Akingbola Omokanye¹

asomokanye@oauife.edu.ng

Obafemi Awolowo University

Clement Kevin Edet²

Rivers State University

Anthony Ike Wegbom²

Rivers State University

Kayode Babatunde Ayilegbe

Federal Neuro Psychiatric Hospital

Research Article

Keywords: Skilled birth attendance, Maternal healthcare utilization, Multilevel analysis, Nigeria Demographic and Health Survey (NDHS), Nigeria

Posted Date: September 25th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10821284/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Skilled birth attendance (SBA), the presence of a doctor, nurse, or midwife at delivery, is one of the most effective interventions for reducing maternal and neonatal mortality, yet its use remains low in Nigeria despite ongoing maternal health programmes. This study estimated the prevalence of SBA and examined its individual- and community-level determinants among women in Nigeria, using the 2024 Nigeria Demographic and Health Survey (NDHS).

Methods

A cross-sectional analytical design was applied to a weighted sample of 13,859 women aged 15–49 years with a recent live birth. Survey weights and the complex sampling design were accounted for using the `svy` command in Stata 17. Descriptive statistics summarised respondents' characteristics and the geographic distribution of SBA, while multilevel mixed-effects logistic regression, reported as adjusted odds ratios (AORs) with 95% confidence intervals, was used to test the individual- and community-level associations.

Results

Overall, 44.6% of women used a skilled birth attendant at their last delivery, with SBA use highest in the South East (87.9%) and lowest in the North West (24.3%). Maternal education, household wealth, parity, antenatal care (ANC) attendance, place of residence, and geopolitical region were all significantly associated with SBA utilization ($p < 0.001$), with use rising sharply with higher education, greater household wealth, and more ANC visits, and falling with rural residence and higher parity. Significant community-level variation was also observed ($ICC = 0.644$), confirming that a substantial share of the variation in SBA lies between communities rather than between individuals, and justifying the multilevel modelling approach.

Conclusions

SBA use in Nigeria remains sub-optimal and is shaped by both individual and community circumstances. Strengthening women's education, promoting antenatal care utilization, and expanding access to quality maternal health services, particularly in rural and northern Nigeria, are critical to closing these gaps and reducing preventable maternal and neonatal deaths.

Clinical trial registration

Not applicable. This is not a clinical trial and therefore did not need to be registered.

Background to the study

Skilled birth attendance (SBA) is one of the most key interventions for the reduction of maternal and neonatal mortality (MNM) at a global level, however there are inequalities in SBA by region. The proportion of births attended by skilled health personnel (SHPs) has gradually increased, with recent estimates indicating that 86–87% of all births in the world currently take place under the care of a skilled health worker (1). In spite of this, maternal deaths are still too high, as there were approximately 260,000 maternal deaths in 2023 and more than 700 deaths every day from preventable causes related to pregnancy and childbirth (2). Skilled health personnel, trained and accredited health workers like doctors, nurses or midwives who can perform both normal and abnormal deliveries, are critical in reducing maternal and neonatal mortality. Practical interventions like having skilled attendants have been proven to significantly lower maternal mortality attributed to complications like hemorrhage and sepsis (3). Additionally, individual- and structural-level determinants are also found to influence SBA utilization, with higher education, high economic status and ANC attendance being significant indicators across the globe (4, 5). Moreover, inequalities in access to skilled care are still high in LMICs; global evidence shows that access to SBA is inequitable due to weak health systems, lack of workforce distribution and financial barriers in LMICs (6).

Maternal mortality has been a significant and disproportionate problem in sub-Saharan Africa, responsible for almost all deaths among women of reproductive age worldwide. There is evidence that a significant percentage of females in the region are still giving birth without skilled birth attendants, and this contributes to high maternal mortality rates in the area (5). It is estimated that 87% of maternal deaths around the world occur in Sub-Saharan Africa, which demonstrates significant inequities in access to quality maternal care services. Disparities occur within and across countries on the continent. In certain African nations, maternal mortality rates are still high, such as Nigeria with an estimated rate of 993 per 100,000 live births in 2023 and Chad with an estimated rate of 748 per 100,000 live births in 2023 (5, 7). Findings from empirical multilevel studies throughout the region indicate that women in less developed areas and in poorer communities are far less likely to have access to SBA than their city counterparts (8). For example, education at the community level and participation in antenatal care have been found to be significant predictors of SBA utilisation (8, 5). These results provide evidence that socio-economic and geographical conditions of communities and health systems infrastructure are equally significant as individual factors in explaining the uptake of maternal health care in Africa (9). Furthermore, recent analyses highlight that health systems in the region remain under-resourced, the skilled workforce is inadequately distributed, and financial access remains a challenge to maternal health services, especially in rural and underserved regions and populations (10).

Despite the interventions, maternal mortality is still a big public health problem in Nigeria. The country is one of the leading nations in the world in contributing to maternal mortality, causing enormous proportion of global maternal mortality that is documented with tens of thousands of maternal deaths

annually (11, 12). According to the Nigeria Demographic and Health Survey (NDHS) data, the rate of skilled attendance at deliveries has been relatively low, with around 45–52% of births attended by skilled birth attendants over the past few years (13, 12). Though there is some degree of improvement, there is significant disparity among the regions, especially between northern and southern regions, with lower utilization of SBA in the northern regions than the southern regions (14, 15, 16).

Women who attend more antenatal care visits, have higher wealth status and better education levels are significantly more likely to use skilled birth attendance, as found on the ground (17, 18, 12). Furthermore, community factors like living in rural areas, distance to health facilities and regional inequalities play a critical role in influencing SBA utilization (19, 20, 21).

The continued differences in SBA utilization highlight the need for methods that address both individual and contextual factors. Although much research has been conducted to explain SBAs' use, many studies have not addressed the hierarchical nature of DHS data or how individual- and community-level factors interact. Thus, there is an urgent need for detailed multi-level analyses with national data to better comprehend the interplay of factors leading to skilled birth attendance in Nigeria.

In summary, the weight of global and regional evidence points to a consistent conceptual pathway: individual-level circumstances (education, wealth, parity, and ANC attendance) and community-level context (place of residence, regional infrastructure, and social norms) jointly shape whether a woman delivers with a skilled attendant, and it is this dependent outcome, SBA utilization, that ultimately drives maternal and neonatal survival. Clarifying the relative and combined contribution of these two levels of determinants in the specific case of Nigeria, using the most recent nationally representative data and a modelling approach suited to the hierarchical structure of DHS data, is therefore both conceptually important and practically urgent for designing effective, targeted maternal health interventions.

Statement of the problem

Despite the ongoing public health promotion and campaigns for skilled birth attendance (SBA), its practice in Nigeria is still suboptimal and maternal and neonatal deaths continue to be a major public health problem in the country. Nigeria has a high burden of maternal mortality attributed to preventable complications that occur during childbirth, which can be managed by well-trained health workers (11, 12).

Previous research in Nigeria have revealed most important individual factors linked to SBA, such as maternal education, household wealth, parity, and utilization of antenatal care (17, 22). Most of these studies, however, have used only one-level analysis methods like logistic regression, which make the assumption of independence of observations (23, 24). The assumption is problematic when analyzing data from Demographic and Health Survey (DHS) as these data are hierarchically structured with women being nested within households and communities. Failure to correct for this clustering can result in

underestimated standard errors and, in turn, inaccurate conclusions, reducing the credibility of policy recommendations based on these analyses.

In addition to the individual factors, community-level factors such as rural-urban residence, regional disparities, access to health facilities and sociocultural norms have been found to have a significant impact on maternal health service utilization (25, 26, 27). The contextual factors, however, have not received much attention or been well explained in some of the previous research in Nigeria.

There is, therefore, a lack of combined individual- and community-level analysis of SBA in Nigeria, which obscures the multilevel dynamics underlying its utilization, and existing single-level analyses of older DHS rounds are unable to correct for this gap using the most current national data.

Significance of the study

Access to the newly released 2024 Nigeria DHS data provides an opportunity to close this analytical gap using multilevel modelling techniques capable of capturing the hierarchical structure of the data and producing more reliable estimates. Multilevel modelling allows the total variance in SBA to be partitioned between the individual and community levels and permits more accurate estimation of contextual effects than single-level methods.

This study is therefore significant on three counts. First, it provides policymakers, including the Federal and State Ministries of Health, with up-to-date, methodologically robust evidence on the individual and community determinants of SBA, using data more recent than that underpinning most existing Nigerian studies. Second, it offers programme implementers, including the National Primary Health Care Development Agency and State Primary Health Care Boards, a basis for designing multilevel, context-specific maternal health interventions rather than interventions targeted at individual behaviour alone. Third, it contributes methodologically to the Nigerian maternal health literature by explicitly quantifying the share of SBA variation attributable to community context (via the intra-class correlation coefficient), thereby strengthening the evidence base for targeted, geographically differentiated resource allocation aimed at reducing preventable maternal and neonatal mortality.

Research objectives

The objective of this study is to evaluate the individual and community factors associated with skilled birth attendance among women aged 15–49 years with a recent live birth in Nigeria, using the 2024 Nigeria Demographic and Health Survey (NDHS). The specific objectives are to:

1. Estimate the weighted prevalence of skilled birth attendance among women aged 15–49 years with recent live births in the 2024 NDHS.
2. Assess the association between intrapersonal/individual factors (maternal education, age, household wealth status, parity and antenatal care attendance) among women aged 15–49 years with recent live births in the 2024 NDHS and skilled birth attendance.

3. 3. Assess the effect of community-level factors (place of residence, geopolitical region) on skilled birth attendance among women aged 15–49 years with recent live births in the 2024 NDHS, after adjusting for individual-level factors.

Research hypotheses

H01: The individual-level factors have no statistically significant association with skilled birth attendance in Nigeria.

H02: The community-level factors have no significant effect on skilled birth attendance in Nigeria.

H03: The difference in skilled birth attendance among communities (clusters) is not statistically significant in Nigeria.

Theoretical framework

This study draws on Andersen's Behavioral Model of Health Services Use (1968, later revised), which explains health-service use through predisposing, enabling, and need factors operating at both the individual and contextual level (28). Predisposing factors (e.g., maternal age, education, parity) shape a woman's motivation to seek skilled care; enabling factors (e.g., household wealth, access to health facilities) determine her practical ability to do so; and need factors reflect perceived or actual health requirements. The model further distinguishes potential access (service availability) from realized access (actual use), and, critically for this study, explicitly incorporates contextual determinants such as community characteristics and health-system structure alongside individual attributes (29, 30). This directly supplies the theoretical basis for the individual-community nexus tested in this study: it predicts that SBA utilization (the dependent variable) is jointly determined by individual predisposing/enabling/need factors and community-level context (the independent variables at each level), and that low SBA in Nigeria reflects unfavourable configurations of both.

This is complemented by the Social Ecological Model (SEM), which conceptualises health behaviour as the product of dynamic interaction across individual, interpersonal, community, organisational, and societal levels of influence (33, 34, 35). Household characteristics, social norms, and health-system attributes such as service quality and geographic access shape maternal delivery choices in sub-Saharan Africa (36, 37). Together, Andersen's model and the SEM provide the theoretical basis for expecting that community-level context, not merely individual characteristics, causally contributes to low SBA uptake in Nigeria, a structure that maps directly onto the hierarchical form of the DHS data and justifies the multilevel modelling approach adopted in this study, whereby SBA is conceptualised as the outcome of interacting individual-level determinants and community-level contextual factors (38).

Methods

This study was designed as a cross-sectional analytical study with data from the Nigeria Demographic and Health Survey (NDHS) 2024, a nationally representative survey with a stratified two-stage cluster sampling design. The first stage involved the selection of enumeration areas (EAs), or clusters, by probability proportional to size (PPS); the second stage involved systematic selection of households within each enumeration area. Stratification criteria were urban–rural residence and geopolitical region.

The 2024 NDHS individual (women's) recode dataset, distributed by the DHS Program in Stata format, was obtained through a formal data request submitted via the DHS Program online repository (dhsprogram.com), following registration and a statement of intended use; access was granted after review and approval by the DHS Program. The dataset was downloaded, imported into Stata 17, and restricted to the study population of women aged 15–49 years who had at least one live birth in the five years preceding the survey. For women with multiple births during this period, only the most recent birth was retained, to reduce recall bias, and records with missing information on key study variables were excluded from the analysis, yielding the final weighted analytic sample of 13,859 women.

The dependent variable was skilled birth attendance (SBA), coded as 1 if the most recent delivery was attended by a skilled health-care provider (doctor, nurse, or midwife) and 0 otherwise. Individual-level explanatory variables were maternal age, education, parity, household wealth index, and antenatal care (ANC) utilization; community-level explanatory variables were place of residence (urban/rural), geopolitical region, and primary sampling unit (cluster).

All analyses were conducted in Stata 17 using the svy suite of commands to account for sampling weights, clustering, and stratification arising from the complex survey design. Descriptive statistics summarised the characteristics of the study population, and single-level (bivariate) logistic regression tested the unadjusted association between each explanatory variable and SBA. A multilevel mixed-effects logistic regression was then fitted to account for the hierarchical structure of the data, with individuals (Level 1) nested within clusters (Level 2). An empty (null) model was first estimated to quantify baseline community-level variation in SBA via the intra-cluster correlation coefficient (ICC); an individual-level model was then fitted; and a final combined model incorporated both individual- and community-level variables. Adjusted odds ratios (AORs) with 95% confidence intervals were reported for all fixed effects, and statistical significance was set at $p < 0.05$.

Ethics approval and consent to participate

The DHS Program's survey implementers obtained ethical approval for NDHS data collection, and permission to use the dataset for this secondary analysis was obtained from the DHS Program; the data are fully anonymised and publicly available upon request. No further ethical approval was required for this secondary analysis. Informed consent of all subjects was obtained by the DHS Program prior to data collection.

Results

Prevalence of skilled birth attendance

Among the weighted sample of 13,859 women aged 15–49 years who had a live birth in the five years preceding the 2024 NDHS, 44.6% reported that a skilled attendant was present at their last delivery, compared with 55.4% who did not (Table 1).

Table 1. *Weighted prevalence of skilled birth attendance among women of reproductive age*

Skilled Birth Attendance (SBA)	Proportion	Percentage (%)
No	0.554	55.4
Yes	0.446	44.6
Total	1.000	100.0

Source: Authors' computation from NDHS 2024 data (weighted, n = 13,859).

Individual-level factors and skilled birth attendance

Survey-weighted bivariate analysis showed that maternal education, household wealth, age, parity, and ANC attendance were all significantly associated with SBA ($p < 0.001$) (Table 2). SBA rose steeply with maternal education, from 18.0% among women with no education to 91.4% among women with higher education, and with household wealth, from 15.7% in the poorest households to 91.0% in the richest. SBA use was highest among women aged 35–39 years (50.6%) and lowest among the youngest (15–19 years, 31.2%) and oldest (45–49 years, 30.5%) age groups. Utilization declined with parity, from 56.1% among women with one child to 30.0% among women with six or more children, and rose sharply with ANC attendance, from 10.4% among women with no ANC visits to 65.2% among those with four or more visits.

Table 2. *Association between individual-level characteristics and skilled birth attendance among women in Nigeria, NDHS 2024 (survey-weighted row percentages)*

Variable	Category	SBA: No (%)	SBA: Yes (%)	p-value
Maternal Education	No education	81.97	18.03	<0.001
	Primary	58.40	41.60	
	Secondary	30.46	69.54	
	Higher	8.57	91.43	
Wealth Index	Poorest	84.29	15.71	<0.001
	Poorer	75.98	24.02	
	Middle	54.65	45.35	
	Richer	29.93	70.07	
	Richest	9.02	90.98	
Age Group (years)	15–19	68.81	31.19	<0.001
	20–24	60.29	39.71	
	25–29	54.92	45.08	
	30–34	50.02	49.98	
	35–39	49.39	50.61	
	40–44	57.02	42.98	
	45–49	69.49	30.51	
Parity	1	43.90	56.10	<0.001
	2–3	51.87	48.13	
	4–5	56.37	43.63	
	6+	70.02	29.98	
ANC Visits	None	89.58	10.42	<0.001
	1–3 visits	65.96	34.04	
	4 or more visits	34.77	65.23	

Source: Authors' computation from NDHS 2024 data (weighted, $n = 13,859$).

[Fig 1 – figure file uploaded separately, per BMC Global and Public Health figure requirements] **Fig 1. Skilled Birth Attendance Utilization by Individual-Level Characteristics in Nigeria, NDHS 2024**

The distribution shown in Fig 1 mirrors the patterns in Table 2, with the steepest gradients evident for maternal education, household wealth, and ANC attendance.

Individual-level multilevel model of skilled birth attendance

Table 3 presents the mixed-effects logistic regression model relating individual-level factors to SBA, accounting for community-level clustering. The overall model was statistically significant (Wald $\chi^2 = 3251.31$, $p < 0.001$).

Table 3. *Mixed-effects logistic regression results for individual-level factors and SBA*

Variable	Category	Coef. (β)	AOR	p-value	Interpretation
Education	Primary	0.551	1.73	<0.001	Increased odds
	Secondary	1.102	3.01	<0.001	Strong positive effect
	Higher	1.826	6.21	<0.001	Very strong positive effect
Wealth Index	Poorer	0.274	1.31	0.001	Increased odds
	Middle	0.923	2.52	<0.001	Moderate positive effect
	Richer	1.474	4.37	<0.001	Strong positive effect
	Richest	2.221	9.22	<0.001	Very strong positive effect
Age Group	20–24	0.018	1.02	0.885	Not significant
	25–29	0.086	1.09	0.518	Not significant
	30–34	0.348	1.42	0.015	Increased odds
	35–39	0.526	1.69	0.001	Increased odds
	40–44	0.650	1.92	<0.001	Increased odds
	45–49	0.533	1.70	0.025	Increased odds
Parity	2–3	-0.496	0.61	<0.001	Reduced odds
	4–5	-0.632	0.53	<0.001	Lower odds
	6+	-0.802	0.45	<0.001	Markedly lower odds
ANC Visits	1–3 visits	1.364	3.91	<0.001	Strong positive effect
	4+ visits	2.001	7.40	<0.001	Very strong positive effect

Reference categories: no education; poorest; 15–19 years; parity 1; no ANC visits.

Table 3b. *Random effects (community-level variation) – individual-level model*

Parameter	Estimate	Interpretation
Cluster variance (v021)	1.144	Significant between-community variation in SBA
LR test vs standard logistic	$\chi^2 = 643.29$, $p < 0.001$	Multilevel model provides a significantly better fit

Source: Authors' computation from NDHS 2024 data.

Maternal education was a strong, graded predictor of SBA: women with primary education were more likely to use SBA (AOR = 1.73, $p < 0.001$), and this likelihood rose further among women with secondary (AOR = 3.01) and higher education (AOR = 6.21, both $p < 0.001$), relative to women with no formal education. Household wealth showed a similarly graded, positive association, with the richest women markedly more likely to use SBA (AOR = 9.22, $p < 0.001$) than the poorest. Maternal age was significantly associated with SBA among older groups (30–44 years and above) relative to the youngest women, but not among women aged 20–29 years. Parity was negatively associated with SBA: women with six or more births were significantly less likely to use skilled care (AOR = 0.45, $p < 0.001$) than women with one birth. ANC attendance was among the strongest predictors, with women attending four or more visits substantially more likely to use SBA (AOR = 7.40, $p < 0.001$). Significant residual community-level variation (variance = 1.144) confirmed that the multilevel model fit the data significantly better than a single-level model ($\chi^2 = 643.29$, $p < 0.001$), providing strong statistical evidence that individual-level factors are significantly associated with SBA in Nigeria.

Community-level factors and skilled birth attendance

Place of residence and geopolitical region were both significantly associated with SBA at the bivariate level ($p < 0.001$) (Table 4). SBA use was substantially higher among urban women (69.1%) than rural women (29.5%). Regionally, SBA use was highest in the South East (87.9%), South West (83.4%), and South South (76.8%), and lowest in the North West (24.3%) and North East (31.4%), with intermediate use in the North Central (53.5%).

Table 4. Association between community-level factors and skilled birth attendance

Variable	Category	SBA: No (%)	SBA: Yes (%)	p-value
Place of residence	Urban	30.9	69.1	<0.001
	Rural	70.5	29.5	
Region (Zone)	North West	75.8	24.3	<0.001
	North East	68.6	31.4	
	North Central	46.5	53.5	
	South East	12.1	87.9	
	South South	23.2	76.8	
	South West	16.6	83.4	

Source: Authors' computation from NDHS 2024 data.

[Fig 2 – figure file uploaded separately, per BMC Global and Public Health figure requirements] **Fig 2.** Skilled Birth Attendance by Region in Nigeria, NDHS 2024

Fig 2 illustrates a distinct north–south gradient in SBA use, with a high-utilization cluster comprising the South East and South South zones, a low-utilization cluster comprising the North East and North West zones, and the North Central zone intermediate between these extremes.

State-level estimates revealed marked subnational variability (Table 5), ranging over 80 percentage points between the highest- and lowest-performing states. The highest SBA use was recorded in Imo (96.3%), Enugu (95.3%), and Abia (94.8%), all in the South East; the lowest was recorded in Kebbi (11.0%), Sokoto (13.0%), and Zamfara (14.7%), all in the North West.

Table 5. Skilled birth attendance by state in Nigeria (top and bottom 10 states)

Rank	State	SBA (%)
1	Imo	96.3
2	Enugu	95.3
3	Abia	94.8
4	Anambra	92.8
5	Edo	91.1
6	Ekiti	89.0
7	Rivers	88.5
8	Osun	87.5
9	Lagos	87.5
10	Oyo	82.9
28	Kaduna	34.7
29	Taraba	32.6
30	Yobe	31.1
31	Bauchi	27.2
32	Jigawa	23.1
33	Adamawa	20.9
34	Katsina	18.4
35	Zamfara	14.7
36	Sokoto	13.0
37	Kebbi	11.0

Source: Authors' computation from NDHS 2024 data. Ranks 11–27 (intermediate states) omitted for brevity; full 37-state ranking available from the corresponding author on request.

*[Fig 3 – figure file uploaded separately, per BMC Global and Public Health figure requirements] **Fig 3.** Skilled Birth Attendance by State in Nigeria, NDHS 2024*

Fig 3 shows that the overall north–south pattern persists at the state level but masks considerable within-region variation, with the southern states generally recording higher SBA use than states in the North West and North East. Together, Table 4, Fig 2, Table 5, and Fig 3 confirm that SBA is highly inequitable across communities in Nigeria and justify the inclusion of community-level variables in the multilevel model that follows.

Combined individual- and community-level multilevel model

Table 6 presents the full mixed-effects logistic regression model, incorporating both individual- and community-level variables (Wald $\chi^2 = 2600.47$, $p < 0.001$).

Table 6. *Effects of individual- and community-level factors on skilled birth attendance*

Variable	Category	Coef. (β)	Std. Err.	p-value	95% CI
Education (v106)	Primary	0.284	0.085	0.001	0.118 – 0.450
	Secondary	0.754	0.076	<0.001	0.605 – 0.902
	Higher	1.530	0.134	<0.001	1.267 – 1.792
Wealth Index (v190)	Poorer	0.126	0.084	0.134	-0.039 – 0.291
	Middle	0.595	0.092	<0.001	0.415 – 0.776
	Richer	0.968	0.106	<0.001	0.760 – 1.175
	Richest	1.525	0.138	<0.001	1.255 – 1.794
Age Group	20–24	-0.037	0.124	0.763	-0.280 – 0.205
	25–29	-0.044	0.133	0.741	-0.304 – 0.216
	30–34	0.137	0.143	0.338	-0.143 – 0.417
	35–39	0.258	0.156	0.097	-0.047 – 0.563
	40–44	0.367	0.174	0.035	0.025 – 0.709
	45–49	0.240	0.239	0.315	-0.228 – 0.709
	50–54	0.125	0.245	0.595	-0.359 – 0.609
Parity	2–3	-0.467	0.081	<0.001	-0.625 – -0.309
	4–5	-0.556	0.098	<0.001	-0.748 – -0.364
	6+	-0.641	0.117	<0.001	-0.870 – -0.411
ANC Visits	1–3 visits	1.493	0.087	<0.001	1.323 – 1.664
	4+ visits	2.054	0.077	<0.001	1.903 – 2.205
Residence (v025)	Rural	-0.580	0.086	<0.001	-0.749 – -0.412
Region (v024)	North East	0.383	0.108	<0.001	0.172 – 0.594
	North Central	1.506	0.111	<0.001	1.288 – 1.724
	South East	2.717	0.157	<0.001	2.409 – 3.025
	South South	0.962	0.132	<0.001	0.703 – 1.222
	South West	1.464	0.143	<0.001	1.184 – 1.744
Random Effect	Var(_cons)	0.693	0.072	—	0.566 – 0.849

Reference categories: no education; poorest; 15–19 years; parity 1; no ANC visits; urban; North West.

Source: Authors' computation from NDHS 2024 data.

After adjustment for community-level characteristics, maternal education and household wealth remained independent, graded predictors of SBA, although the poorer wealth category was no longer statistically significant, suggesting that some of the unadjusted wealth effect operates through community context. The effect of maternal age attenuated, remaining significant only for women aged 40–44 years, while parity and ANC attendance remained strongly and significantly associated with SBA. Rural residence was independently associated with markedly lower odds of SBA ($\beta = -0.580$, $p < 0.001$), and all regions had significantly higher odds of SBA than the North West, most markedly the South East ($\beta = 2.717$, $p < 0.001$). The residual cluster-level variance fell to 0.693 once individual and community predictors were included, yet remained statistically significant ($\chi^2 = 312.43$, $p < 0.001$), indicating that unobserved community-level factors continue to shape SBA and providing strong statistical evidence that community-level factors are significantly associated with SBA in Nigeria, even after adjusting for individual-level factors.

Community-level variation in skilled birth attendance (null model)

To quantify the baseline scale of community-level clustering that motivates the multilevel approach, an empty (null) multilevel model was estimated (Table 7).

Table 7. Random-intercept (null) multilevel logistic regression model showing community-level variation in skilled birth attendance among women in Nigeria, NDHS 2024

Parameter	Estimate	Std. Err. / z	p-value	95% CI
Fixed Effect: Intercept (_cons)	0.653	0.073 / z = 8.90	<0.001	0.510 – 0.797
Random Effect: Variance, cluster (v021)	5.939	0.384	—	5.232 – 6.741
Log Likelihood	-7021.996	—	—	—
LR Test vs Logistic Model	$\chi^2 = 5124.63$	—	<0.001	—
Intraclass Correlation (ICC)	0.644	0.015	—	0.614 – 0.672

Source: Authors' computation from NDHS 2024 data.

The ICC of 0.644 indicates that 64.4% of the total variation in SBA is attributable to differences between communities rather than to individual characteristics, and the likelihood ratio test confirmed that the multilevel model fit the data significantly better than a standard logistic model ($\chi^2 = 5124.63$, $p < 0.001$), providing strong statistical evidence that skilled birth attendance varies significantly across communities in Nigeria and formally justifying the multilevel modelling approach adopted throughout this study.

Discussion

This study found that skilled birth attendance among women of reproductive age in Nigeria stood at 44.6%, meaning that just under half of deliveries were attended by a skilled health worker while the majority were not. This indicates a continuing shortfall in obstetric care coverage despite ongoing maternal health interventions; while the level observed suggests some improvement over time, it remains insufficient to meaningfully reduce preventable maternal and neonatal deaths. The prevalence is broadly consistent with earlier national estimates (12, 13) and with the 2018 NDHS figure of 44.9%, suggesting relative stability in SBA utilization over recent years, though it is somewhat lower than the roughly 52% reported in some other studies, a divergence plausibly attributable to differences in analytical approach or measurement. By contrast, higher SBA coverage documented in some other sub-Saharan African countries has been attributed to stronger primary healthcare systems and more consistently implemented universal maternal health policies (39), suggesting that Nigeria's comparatively modest coverage may reflect gaps in policy implementation rather than an absence of policy frameworks.

Maternal education, parity, and ANC attendance emerged as significant individual-level determinants of SBA, corroborating earlier work identifying socioeconomic status and health-care access as key drivers of maternal health-service use (3, 4, 5, 9). The comparatively modest independent effect of maternal age, relative to studies elsewhere that report age as a strong predictor (41), suggests that in the Nigerian context age effects may operate largely through their association with education and antenatal care rather than directly. The strength of the ANC–SBA association observed here, stronger than in some other settings, further suggests that antenatal care may function as Nigerian women's principal point of entry into the formal health system and, consequently, as an unusually strong lever for downstream SBA uptake, a relationship that appears comparatively weaker in more integrated health systems where delivery care is less contingent on prior antenatal engagement (42).

At the community level, the significant urban–rural and regional differences observed are consistent with earlier Nigerian evidence (14, 15, 19), though the scale of the north–south disparity found here appears larger than in some prior work, which may indicate widening rather than narrowing inequality, potentially reflecting differences in security context, economic development, and health-system capacity across regions; comparable analyses in more politically stable settings have found less pronounced polarization, underscoring the likely role of context-specific instability (20, 21). The substantial residual community-level clustering that persisted even after adjustment for individual and community covariates points to unmeasured contextual factors, such as service quality, health-facility density, or cultural norms, that are not captured by the variables available in the DHS, in contrast to settings where clustering diminishes substantially once socioeconomic factors are accounted for (24). Considered together, these individual- and community-level findings indicate that closing Nigeria's SBA gap will require interventions that simultaneously target individual socioeconomic barriers and structural, place-based inequities in the health system, rather than either in isolation.

Theoretical applications to findings

These findings lend empirical support to Andersen's Behavioral Model of Health Services Use and the Social Ecological Model, while also clarifying the boundaries of their applicability in a context of pronounced socioeconomic and geographic inequality. Consistent with Andersen's model, the observed associations between predisposing factors (maternal education, parity), enabling factors (household wealth, place of residence), and the need-related proxy of ANC attendance and SBA utilization confirm that health-care-seeking behaviour in this context is jointly shaped by individual readiness and access (28, 29, 30). However, the persistence of substantial regional disparity and community-level clustering after adjustment for individual characteristics suggests that Andersen's model, on its own, does not fully capture the extent of structural constraint present in Nigeria, where health infrastructure is markedly unevenly distributed.

The Social Ecological Model offers a more complete account of this residual pattern: the scale of community-level variation and regional disparity observed here is consistent with the SEM's premise that health behaviour is shaped by interacting individual, community, and policy-level influences, with rural–urban and regional differences in SBA plausibly reflecting structural factors such as health-facility availability, transport access, and local implementation of health policy (33, 34, 35). The persistence of unexplained community-level variation after adjustment further suggests that additional contextual factors, including quality of care and health-system trust, not measured in this dataset, also play a role. Overall, Andersen's model and the SEM are complementary rather than competing in this context: the former explains individual- and household-level patterning of SBA, while the latter accounts for the structural, community-level variation that remains, jointly supporting a multilevel intervention strategy addressing both individual socioeconomic barriers and broader health-system and contextual inequalities.

Limitations

The study was conducted using secondary data from the NDHS; therefore, only variables available in the dataset were analysed, and some factors such as quality of maternal health-care services, provider attitudes, distance to health facilities, cultural beliefs, and transportation were not measured. Exposure and outcome were measured at a single point in time in the cross-sectional NDHS design, which limits the ability to make causal inferences. Skilled birth attendance and other maternal health indicators were self-reported and therefore subject to recall bias and social desirability bias, particularly for births that occurred several years before the survey. Antenatal care (ANC) attendance and skilled birth attendance (SBA) may both reflect an underlying, unmeasured tendency toward formal health-care-seeking behaviour; this shared underlying behaviour is a plausible contributor to the strong observed ANC–SBA association (AOR = 7.40) and means this association should not be interpreted as purely causal.

Conclusions

This study found that skilled birth attendance in Nigeria remains sub-optimal, at 44.6%, with pronounced disparities by socioeconomic status and geography. Household wealth, maternal education, parity, ANC attendance, place of residence, and geopolitical region were all significant determinants, and substantial community-level variation persisted even after individual-level adjustment (ICC = 0.644), confirming that contextual factors play a central, independent role alongside individual circumstances. Improving SBA in Nigeria will therefore require a multilevel intervention strategy that addresses individual socioeconomic barriers while simultaneously expanding access to quality maternal health services in rural and under-served northern communities.

Recommendations

Based specifically on the individual- and community-level determinants identified in this study, the following are recommended:

1. Given the strong positive gradient between antenatal care attendance and SBA (AOR = 7.40 for 4+ ANC visits), the Federal Ministry of Health and Social Welfare, the National Primary Health Care Development Agency (NPHCDA), and State Primary Health Care Boards should intensify efforts to promote early and regular ANC attendance, particularly among women with low education and low household wealth.
2. Given the marked rural–urban gap (69.1% vs 29.5%) and the pronounced north–south disparity in SBA (South East 87.9% vs North West 24.3%), the Federal and State Ministries of Health should prioritise the deployment and adequate staffing of skilled birth attendants in rural communities and in the North West and North East geopolitical zones specifically.
3. Given the strong, graded association between maternal education and SBA (AOR = 6.21 for higher education), the Federal Ministry of Education, in collaboration with the Federal Ministry of Women Affairs and State Governments, should strengthen female education and women's empowerment programmes as a maternal health strategy.
4. Given the strong wealth gradient in SBA use (15.7% among the poorest vs 91.0% among the richest), the National Health Insurance Authority (NHIA), State Governments, and the Federal Ministry of Humanitarian Affairs and Poverty Reduction should expand financial-protection mechanisms and targeted maternal health subsidies for women from low-income households.
5. Given the large, statistically significant residual community-level variation (ICC = 0.644) that persisted even after adjusting for individual factors, the Federal and State Ministries of Health, with development

partners, should design and implement community-specific maternal health interventions rather than relying solely on individual-level behaviour-change strategies.

Implications of the study

1. Because both individual-level factors (AOR up to 9.22 for household wealth) and community-level factors (β up to 2.717 for South East region) were independently and significantly associated with SBA, a multilevel strategy, combining individual behaviour-change interventions with community- and health-system-level investment, is required to meaningfully improve SBA in Nigeria.
2. The magnitude of the rural–urban gap (69.1% vs 29.5%) and the 80-percentage-point range in SBA across states (Imo 96.3% vs Kebbi 11.0%) indicate that maternal health resources are inequitably distributed, and that geographically targeted, rather than uniform national, policies are needed to close this gap.
3. The scale of unexplained community-level variation (ICC = 0.644, even after adjustment) indicates that community and health-system strengthening, alongside women's education, economic empowerment, and expanded ANC access, must be pursued jointly rather than sequentially, since no single intervention level is sufficient on its own.

Contributions to knowledge

1. This study provides the first nationally representative estimates of SBA prevalence and its spatial distribution based on the 2024 NDHS, the most recent round of Nigeria's Demographic and Health Survey, updating estimates that in most prior Nigerian studies were based on the 2018 NDHS or earlier.
2. Unlike the majority of existing Nigerian SBA studies, which rely on single-level logistic regression and therefore cannot separate individual from community influences, this study applies multilevel mixed-effects logistic regression to explicitly partition and quantify the community-level share of SBA variation (ICC = 0.644), demonstrating that community context contributes as much to SBA utilization as individual characteristics, a distinction not previously quantified for Nigeria using the most current data.
3. By additionally disaggregating findings to the state level, alongside the regional and individual-level analysis, this study identifies specific high- and low-performing states (e.g., Imo at 96.3% versus Kebbi at 11.0%) that are obscured by regional averages, providing a level of geographic granularity, and correspondingly a basis for state-specific resource allocation, that is largely absent from earlier regional-level Nigerian analyses.

Declarations

Ethics approval and consent to participate

The data for this study is secondary data that was obtained from the Nigeria Demographic and Health Survey (NDHS) 2024, which is publicly available anonymous data. The NDHS was implemented with ethical approval from the relevant national and institutional ethics committees, and informed consent of all subjects was obtained before data collection. The DHS Program granted permission to use the dataset in this study. No further ethical approval was required for this secondary analysis.

Consent for publication

Not applicable. No data was collected from identifiable persons as part of the study.

Availability of data and materials

The data that support the findings of this study are available from the Demographic and Health Survey (DHS) Program, but restrictions apply to the availability of these data, which were used under license for the current study. Data are accessible from the authors upon reasonable request and with permission of the DHS Program.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was self-financed. There was no funding from outside sources for this study.

Authors' contributions

SAO was involved in the conception of the study, in the initiation of the study design, data analysis and coordination, and in drafting the manuscript. CKE participated in the design and coordination of the study and provided critical review of the manuscript for intellectual content. AIW helped with the design of the study and coordination and reviewed the manuscript. BKA was involved in study design, study coordination, data collection, and data analysis. All authors have read and approved the final manuscript, and will be accountable for all aspects of the work, in accordance with the recommendations of the International Committee of Medical Journal Editors.

Clinical trial registration

Not applicable. This is not a clinical trial and therefore did not need to be registered.

Acknowledgements

The authors would like to thank the Demographic and Health Survey (DHS) Program for providing access to the NDHS 2024 data used in this study.

References

1. Endale HT, Asefa T, Mengstie TA, Getnet M, Endalew HL, Getahun AB, Dessie G, Yewodiaw TK, Enyew EF. Determinants of skilled birth attendant delivery among reproductive age women in Lesotho: A multilevel analysis of demographic and health survey data. *PLoS ONE*. 2026;21(1):e0340011.
2. World Health Organization. Maternal mortality. 7th April, 2025, © 2026 WHO.
3. Ameyaw EK, Dickson KS. Skilled birth attendance in Sierra Leone, Niger, and Mali: analysis of demographic and health surveys. *BMC Public Health*. 2020;20(1):164.
4. Agbaza-Mogbojuri B, Onwubuyah AO. Socioeconomic and Cultural Influences on antenatal care Utilization: A Multilevel analysis. *World J Biology Pharm Health Sci*. 2023;14(2):329–37.
5. Negash WD, Wubneh HD. Skilled birth attendance and its associated factors in Chad and Nigeria: A multilevel analysis of DHS data. *PLOS Global Public Health*. 2025;5(12):e0005290.
6. Abredu J, Dwumfour CK, Alipitio B, Alordey M, Dzomeku VM, Witter S. A scoping review of the residual barriers to skilled birth attendance in Ghana: A conceptual framework and a fish bone analysis. *PLOS Global Public Health*. 2024;4(2):e0002902.
7. SHEHU H, IDRIS I. SHUAIBU S. Indoor air pollution, maternal and neonatal mortality nexus: evidence from low- and middle-income countries. *J Manage Sci Entrepreneurship*. 2025 Oct 14.
8. Ayalew HG, Assefa KT, Desalegn SY, Mesele TT, Anteneh TA, Tibebu NS, Liyew AM. Individual and community-level determinants of skilled birth attendant delivery in Ethiopia; multilevel analysis. *PLoS ONE*. 2023;18(8):e0289145.
9. Simona S, Lumamba C, Moyo F, Ng'andu E, Phiri M. The influence of contextual factors on maternal healthcare utilization in sub-Saharan Africa: a scoping review of multilevel models. *MedRxiv*. 2022 Mar;18:2022–03.
10. Debie A, Wilson A, Geremew AB, Roberts CT, Wassie MM, Stephens JH. The facilitators and hindrances of the financing modalities for providing universal maternal healthcare services in East Africa: qualitative systematic review. *BMC Health Serv Res*. 2025;25(1):897.
11. Ganeshan M, Arulkumaran S. Global maternal mortality ratios: Trends and strategic approaches to making an impact. *Die Gynäkologie*. 2026;59(4):231–46.
12. Unegbu UL. Determinants of skilled birth attendance in Nigeria: a population-based analysis of the 2018 Demographic and Health Survey. *medRxiv*. 2026 Apr 23:2026–04.
13. Oweibia M, Elemuwa CO, Egberipou T, Timighe GC, Sylvanus P, Wilson TR. Maternal and child health trends in Nigeria: A scoping review of NDHS 2018 vs. NDHS 2023. *MedRxiv*. 2025 May 19:2025–05.
14. Fagbamigbe AF, Oyedele OK. Multivariate decomposition of trends, inequalities and predictors of skilled birth attendants utilisation in Nigeria (1990–2018): a cross-sectional analysis of change drivers. *BMJ open*. 2022;12(4):e051791.
15. Zegeye B, Ahinkorah BO, Ameyaw EK, Budu E, Seidu AA, Olorunsaiye CZ, Yaya S. Two decades of disparities in skilled birth attendant and neonatal mortality rate in Guinea. *BMC Pregnancy Childbirth*. 2022;22(1):56.

16. Chowdhury SS, Kundu S, Sharif AB. Socioeconomic and geographical inequalities in using skilled birth attendants during delivery in Bangladesh over two decades. *BMC Pregnancy Childbirth*. 2023;23(1):430.
17. Afape AO, Azubuike PC, Ibikunle OO, Barrow A. Prevalence and determinants of skilled birth attendance among young women aged 15–24 years in Northern Nigeria: evidence from multiple indicator cluster survey 2011 to 2021. *BMC Public Health*. 2024;24(1):2471.
18. Nuru SM, Mustapha AD, Muhammad LG. Multilevel determinants of skilled birth attendance among adolescent mothers in Northern Nigeria: evidence from national survey data.
19. Teshale AB, Alem AZ, Yeshaw Y, Kebede SA, Liyew AM, Tesema GA, Agegnehu CD. Exploring spatial variations and factors associated with skilled birth attendant delivery in Ethiopia: geographically weighted regression and multilevel analysis. *BMC Public Health*. 2020;20(1):1444.
20. Armah-Ansah EK, Bawa B, Dindas J, Budu E, Ahinkorah BO, Ameyaw EK. A multilevel analysis of social determinants of skilled birth attendant utilisation among married and cohabiting women of Madagascar. *Int Health*. 2024;16(6):642–52.
21. Andargie TA, Lealem EB, Andargie BA. Urban-rural disparities in skilled birth attendance among women in Ethiopia: Multivariate decomposition analysis. *PLoS ONE*. 2025;20(7):e0327565.
22. Adewuyi EO, Auta A, Omonaiye O, Adewuyi MI, Olutuase V, Adefemi K, Odeyemi OA, Zhao Y, Tessema GA, Pereira G. Home birth and associated factors in Nigeria: A comparative study of rural and urban settings—Analysis of national population-based data. *PLoS ONE*. 2025;20(11):e0337438.
23. Harris JK. Primer on binary logistic regression. *Family Med community health*. 2021;9(Suppl 1):e001290.
24. Dey D, Haque MS, Islam MM, Aishi UI, Shammy SS, Mayen MS, Noor ST, Uddin MJ. The proper application of logistic regression model in complex survey data: a systematic review. *BMC Med Res Methodol*. 2025;25(1):15.
25. Bozkurt B, Planey AM, Aijaz M, Weinstein JM, Cilenti D, Shea CM, Khairat S. Disparities in maternal health visits between rural and urban communities in the United States, 2016–2018. *Permanente J*. 2024;28(2):36.
26. Adetunji A, Omotosho AY, Anaba U, Etim EO. Urban-Rural Disparities in Health Facility Deliveries in Nigeria (2007–2021): Decomposition and Concentration Index Analyses.
27. Oyinlola FF, Okorafor KA, Kupoluyi JA, Ogbeye GB, Ouedraogo L, Umar L, Shittu IO. Regional variations in prevalence and factors associated with maternal healthcare services utilisation in Nigeria. *BMC Womens Health*. 2025 Dec 30.
28. Alkhawaldeh A, ALBashtawy M, Rayan A, Abdalrahim A, Musa A, Eshah N, Khait AA, Qaddumi J, Khraisat O, ALBashtawy SD. Application and use of Andersen's behavioral model as theoretical framework: a systematic literature review from 2012–2021. *Iran J public health*. 2023;52(7):1346.
29. Solanke BL, Yinusa RA, Oyeleye OJ, Oluwatope OB, Ilesanmi BB, Oni TO. Using Andersen's behavioral model of health care use for intermittent preventive treatment of malaria in pregnancy in Nigeria. *BMC Pregnancy Childbirth*. 2023;23(1):315.

30. Radhamony R, Cross WM, Townsin L, Banik B. Culturally and linguistically diverse community access and utilisation of the mental health service: an explanation using Andersen's behavioural model. *Issues Ment Health Nurs.* 2024;45(7):758–65.
31. Kpodotsi A, Baku EA, Adams JH, Alaba O. Socioeconomic inequalities in access and use of skilled birth attendants during childbirth in Ghana: a decomposition analysis. *BMC Pregnancy Childbirth.* 2021;21(1):850.
32. Yaya S, Ghose B. Global inequality in maternal health care service utilization: implications for sustainable development goals. *Health equity.* 2019;3(1):heq–2018.
33. Kilanowski JF. Breadth of the socio-ecological model. *J Agromed.* 2017;22(4):295–7.
34. Olaniyan A, Isiguzo C, Hawk M. The Socioecological Model as a framework for exploring factors influencing childhood immunization uptake in Lagos state, Nigeria. *BMC Public Health.* 2021;21(1):867.
35. Yolene G, Ravenell J, Steptoe R, Douglas D, Camille J, Castor C. Socio ecological model (SEM) and diffusion of innovation (DOI) integrated framework: A proposal for integration to improve intervention in the digital age of medicine. *Innovations Pharm.* 2024;15(4):10–24926.
36. Egwuaba EU, Aliu M, Sunday BA, Emegha KN, Chike AS, Ignatius US, Emmanuel CI. Exploring hidden barriers to maternal and child health in low resource communities of Keffi Nasarawa State using a mixed methods approach. *Discover Public Health.* 2026;23(1):672.
37. Yihune Teshale M, Bante A, Gedefaw Belete A, Crutzen R, Spigt M, Stutterheim SE. Barriers and facilitators to maternal healthcare in East Africa: a systematic review and qualitative synthesis of perspectives from women, their families, healthcare providers, and key stakeholders. *BMC Pregnancy Childbirth.* 2025;25(1):111.
38. Lederle M, Tempes J, Bitzer EM. Application of Andersen's behavioural model of health services use: a scoping review with a focus on qualitative health services research. *BMJ open.* 2021;11(5):e045018.
39. Souaibou M, Sandie AB, Barros AJ, Dzossa AD, Sidze EM. Inequalities in effective coverage of the maternal healthcare continuum in Cameroon: a cascade analysis from service contact to input-adjusted coverage. *BMC Health Serv Res.* 2025;25(1):1193.
40. Kabiru CW, Munthali A, Sawadogo N, Ajayi AI, Asego C, Ilboudo PG, Khisa AM, Kimemia G, Maina B, Mangwana J, Mbuthia M. Effectiveness of conditional cash transfers, subsidized child care and life skills training on adolescent mothers' schooling, sexual and reproductive health, and mental health outcomes in Burkina Faso and Malawi: the PROMOTE Project pilot randomized controlled trial protocol. *Reproductive Health.* 2023;20(1):166.
41. Olubodun T, Rahman SA, Odukoya OO, Okafor IP, Balogun MR. Determinants of health facility delivery among young mothers aged 15–24 years in Nigeria: a multilevel analysis of the 2018 Nigeria demographic and health survey. *BMC Pregnancy Childbirth.* 2023;23(1):185.
42. Zhu Z, Wang H, Zhu T, Wang Z, Shen Y, Xiong C, Jiang H. Mental health service utilization among pregnant and postpartum women: status, determinants, and insights from a mixed-methods study.

Figures

Skilled Birth Attendance (SBA) Utilization by Individual-Level Characteristics in Nigeria, NDHS 2024

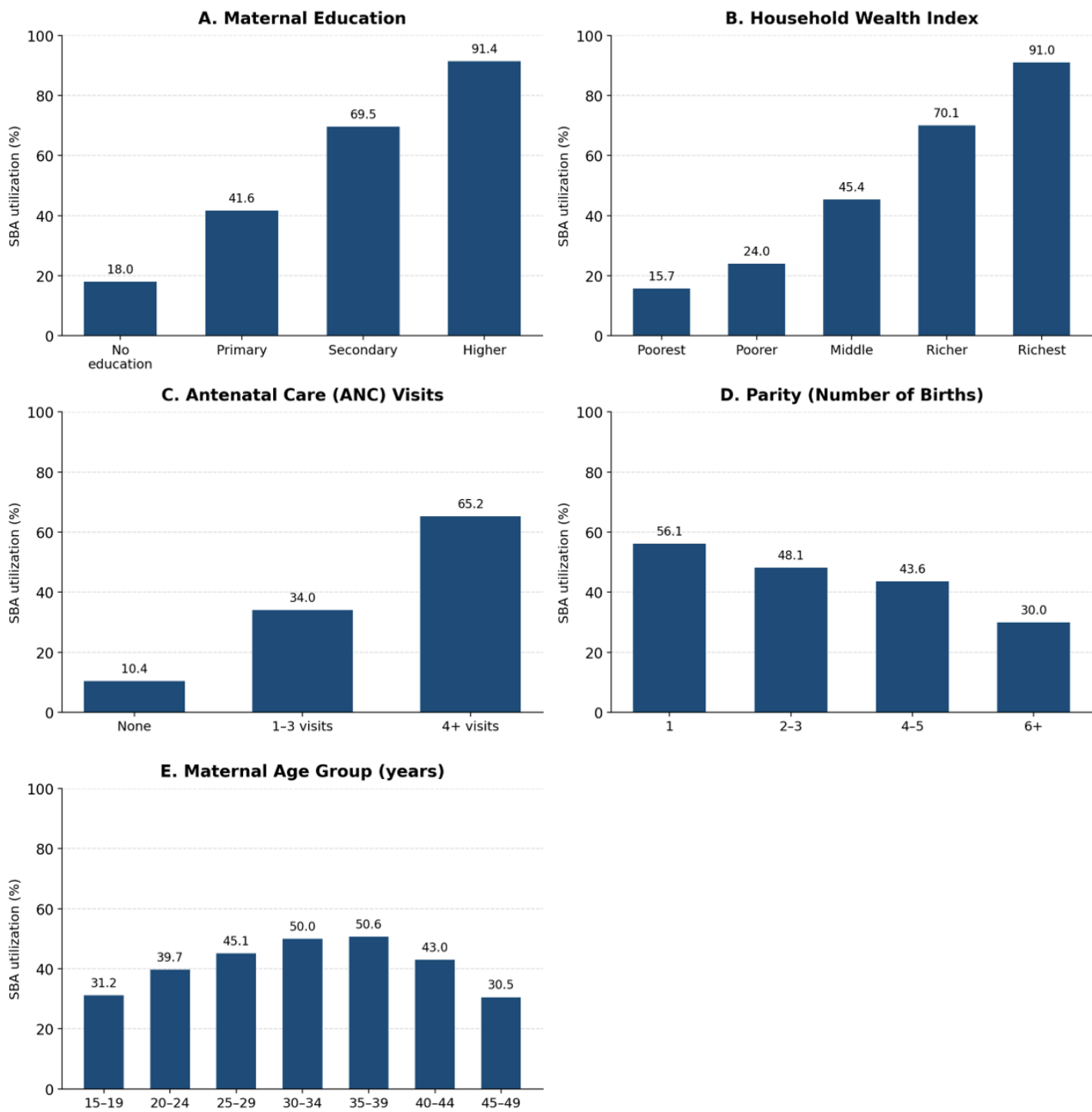


Figure 1

SBA Utilization by Individual Level Characteristics

Skilled Birth Attendance by Region, Nigeria 2024



Figure 2

Skilled Birth Attendance by Region in Nigeria, NDHS 2024

Skilled Birth Attendance by State, Nigeria, 2024



Figure 3

Skilled Birth Attendance by State in Nigeria, NDHS 2024

